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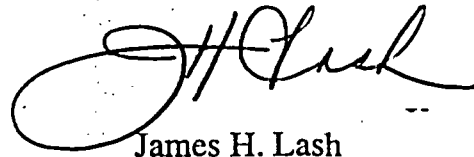
May 24, 2006
L-06-091

Beaver Valley Power Station, Unit No. 2
Docket No. 50-412 License No. NPF-73
LER 2006-001-00

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

The following Licensee Event Report Supplement is submitted:

LER 2006-001-00, 10 CFR 50.73(a)(2)(iv)(A), "Turbine-Generator Trip Due to Loss of Generator Excitation Power Results in Reactor Trip."



James H. Lash

Attachment

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Sr. Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
INPO Records Center (via electronic image)
Mr. L. E. Ryan (BRP/DEP)

IE22

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to Infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

Beaver Valley Power Station Unit Number 2

2. DOCKET NUMBER

05000412

3. PAGE

1 OF 4

4. TITLE

Turbine-Generator Trip Due to Loss of Generator Excitation Power Results in Reactor Trip

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	02	2006	2006	- 001 - 00		05	24	2006	None	
									FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(a)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
10. POWER LEVEL	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify In Abstract below
				or In NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

L. R. Freeland, Manager Regulatory Compliance

TELEPHONE NUMBER (Include Area Code)

(724) 682-4284

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	TL	EXC	West.	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete EXPECTED SUBMISSION DATE). ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH DAY YEAR

16. ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On April 2, 2006, the Beaver Valley Power Station (BVPS) Unit No. 2 reactor tripped at 1402 hours due to a Main Generator Loss of Field Protection Trip. All safety systems functioned as designed. Both Emergency Diesel Generators (EDGs) automatically started due to a momentary under voltage condition caused by the initial Main Generator trip. Both EDGs ran unloaded. All three Auxiliary Feedwater System pumps started as expected on low steam generator levels. The plant was stabilized in Mode 3 with primary and secondary parameters returned to normal hot standby values.

The root cause of the generator trip has been determined to be less than adequate workmanship, manufacturing and/or disassembly inspections. Initial inspection by the vendor (post-trip) identified that the block which supports the field pole #1 and field pole #2 terminals was not present. With this block missing, the field pole connection is subject to increased flexing during normal operation and also during maintenance activities. This increased flexing led to fatigue failure of the Exciter Field. With the open circuit resulting from the failed pole connection, the Main Generator tripped on loss of field. It was indeterminate if the support block was removed during one of the Exciter inspections/ disassemblies or never installed during the manufacturing process.

This reactor trip is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an event which resulted in the valid automatic actuation of the Reactor Protection System, the Auxiliary Feedwater System, and the onsite emergency AC electrical power systems - Emergency Diesel Generators per 10 CFR 50.73(a)(2)(iv)(B).

The risk was determined to be very low safety significance.

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

PLANT AND SYSTEM IDENTIFICATION

Westinghouse-Pressurized Water Reactor {PWR}
Main Generator Excitation System {TL}

CONDITIONS PRIOR TO OCCURRENCE

Unit 2: Mode 1 at 100 percent power.

There were no systems, structures, or components that were inoperable at the start of the event that contributed to the event other than as described below.

DESCRIPTION OF EVENT

On April 2, 2006, the Beaver Valley Power Station (BVPS) Unit No. 2 reactor tripped at 1402 hours due to a Main Turbine trip from a Main Generator Loss of Field Protection Trip. The first out computer point was Main Generator Loss of Field along with Generator Protection Generator Trip. Following the reactor trip, safety systems functioned as designed. Although both safety related emergency busses correctly switched automatically to their respective offsite power feed when the Main Generator tripped, both Emergency Diesel Generators (EDGs) automatically started due to a momentary under voltage condition caused by the initial Main Generator trip. Both EDGs ran unloaded. All three Auxiliary Feedwater System pumps started as expected on low steam generator levels. The plant was stabilized in Mode 3 with primary and secondary parameters returned to normal hot standby values.

Subsequent investigation discovered that an open circuit existed on a series connected field pole of the Exciter on the BVPS Unit No. 2 Main Generator. The open circuit was a tear in the No. 2 series field pole terminal which connected the No. 1 coil to the No. 2 coil. The tear was across the entire terminal. The open circuit can best be described as a fracture which propagated until the connector had insufficient current carrying capability. With the open circuit resulting from the failed pole connection, the Main Generator tripped on loss of field. This No. 2 series field coil was the only coil in which a support block was not installed between the top and bottom terminals.

The No. 2 EDG experienced a control power alarm when it was shutdown from its unloaded condition approximately one and one half hours after the reactor trip. This was due to a failure of a diode in the EDG's voltage regulator motor operator controller bridge following the normal small voltage surge experienced whenever the EDG is shutdown. This failure was unrelated to the reactor-generator trip event. The EDG would have functioned satisfactorily prior to its manual shutdown.

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

CAUSE OF EVENT

The direct cause of the reactor trip was a turbine trip, caused by a main generator trip. The main generator tripped the main turbine, which will then cause a reactor trip if power is above 49 percent.

The root cause of the generator trip has been determined to be less than adequate workmanship, manufacturing and/or disassembly inspections. Initial inspection by the vendor (post-trip) identified that the block which supports the field pole #1 and field pole #2 terminals was not present. With this block missing, the field pole connection is subject to increased flexing during normal operation and also during maintenance activities. This increased flexing led to fatigue failure of the Exciter Field. The missing support block on pole #2 should have been installed prior to shipment to Beaver Valley Power Station. It was indeterminate if the support block was removed during one of the Exciter inspections/disassemblies (performed by the vendor at a ten year frequency), or never installed during the manufacturing process.

REPORTABILITY

On April 2, 2006, Unit 2 experienced a reactor trip at 1402 hours. This is reportable pursuant to 10 CFR 50.72(b)(2)(iv)(B) as an actuation of the Reactor Protection System when the reactor is critical and pursuant to 10 CFR 50.72(b)(3)(iv)(A) as an event that resulted in the valid automatic actuation of the Reactor Protection System, Auxiliary Feedwater System and Emergency Diesel Generators. BVPS notified the Nuclear Regulatory Commission per 10 CFR 50.72 via EN No. 42467 at 1546 EST on April 2, 2006.

This reactor trip is reportable pursuant to 10 CFR 50.73(a)(2)(iv)(A) as an event that was not part of a pre-planned sequence which resulted in the valid automatic actuation of: the Reactor Protection System per 10 CFR 50.73(a)(2)(iv)(B)(1), and of the Auxiliary Feedwater System per 10 CFR 50.73(a)(2)(iv)(B)(6), and of the onsite emergency AC electrical power systems - Emergency Diesel Generators per 10 CFR 50.73(a)(2)(iv)(B)(8).

SAFETY IMPLICATIONS

At the time of the reactor trip, no components credited in the current PRA model were unavailable. All safety systems functioned as designed. This event is bounded by the Design Basis "Loss of External Electrical Load and/or Turbine Trip" described in Section 14.1.7 of the BVPS Unit 1 Final Safety Analysis Report (UFSAR).

The plant risk associated with the BVPS Unit 2 reactor trip that occurred on April 2, 2006, due to the main generator trip is considered to be low. This is based on the conditional

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17. NARRATIVE (If more space is required, use additional copies of NRC Form 366A)

SAFETY IMPLICATIONS (Continued)

core damage probability for the event when considering the actual component unavailability that was present at the time of the reactor trip.

Based on the above, the reactor trip safety significance on April 2, 2006, was very low.

CORRECTIVE ACTIONS

1. The exciter field coil was replaced and a support block installed.
2. The existing main exciter preventative maintenance task is being revised to ensure that the proper details exist on disassembly and reassembly of the exciter field pole connectors.
3. A generator/exciter preventative maintenance template is being developed to include a mechanical inspection of the exciter which includes the exciter stator series lead connections and a verification of the presence of all the stator field lead support blocks.

Completion of the above and other corrective actions are being tracked through the BVPS corrective action program.

PREVIOUS SIMILAR EVENTS

A review found one prior BVPS Unit 1 and no prior BVPS Unit 2 Licensee Event Reports within the last ten years involving a main generator problem.

- LER 1-99-010, "BVPS Unit 1 Manual Reactor Trip Due to Main Unit Generator Voltage Regulator Malfunction". This manual trip was initiated following cyclic field current variations observed in the control room, subsequently determined to be from a degraded voltage regulator logic drawer. The cause of this event was not similar to the cause of the Main Generator event on April 2, 2006.

COMMITMENTS

There are no new commitments made by FirstEnergy Nuclear Operating Company (FENOC) for BVPS Unit No. 2 in this document.